

Notice of Allowability

Application No.

10/725,138

Applicant(s)

TAO ET AL.

Examiner

Art Unit

Beth E. Owens

2824

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☐ This communication is responsive to ____.
2. ☒ The allowed claim(s) is/are 1-23.
3. ☒ The drawings filed on 01 December 2003 are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some* c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: ____.


Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date ____.
- (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date ____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08),
Paper No./Mail Date 01222004
4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413),
Paper No./Mail Date ____.
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other ____.


VANTHU NGUYEN
PRIMARY EXAMINER

Examiner's Amendment

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to Applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

In the Specification:

Replace the title with --Process of Dual or Single Damascene Utilizing Separate Etching and DCM Apparati--.

Page 5, lines 19-20: replace "C_xF_y, C_xF_yH_z, SF₆, or NF₃" with --C_xF_y, C_xF_yH_z, SF₆ or NF₃--.

In the Abstract:

Line 2: replace "comprises" with --entails--.

In the Claims:

Claim 3, line 2: replace "fluorine-contained" with --fluorine-containing--.

Claim 4, line 2: replace "O₂, H₂O, H₂, NH₃, N₂," with --O₂, H₂O, H₂, NH₃, N₂--.

Claim 12, line 2: replace "C_xF_y, C_xF_yH_z, SF₆, or NF₃" with --C_xF_y, C_xF_yH_z, SF₆ or NF₃--.

Claim 20, line 2: replace "fluorine-contained" with --fluorine-containing--.

Claim 21, line 2: replace "O₂, H₂O, H₂, NH₃, N₂," with --O₂, H₂O, H₂, NH₃, N₂--.

Allowance

2. Claims 1-23 are allowed.
3. The following is an examiner's statement of reasons for allowance:

There is no prior art available nor obvious motivation to combine elements of prior art which teach a process of dual damascene or damascene, comprising the steps of: providing an etching apparatus, a DCM (dry cleaning module) machine and a wafer, the wafer having a metal line, a stop layer, a dielectric layer, and a photoresist; etching the dielectric layer in the etching apparatus to form a via hole the dielectric layer; ashing the photoresist in the DCM machine with an inductively coupled plasma; and wet cleaning the wafer;

and:

A process of dual damascene or damascene, comprising the steps of: providing an etching apparatus, a DCM machine and a wafer, the wafer having a metal line, a stop layer, a dielectric layer, a contact, and a photoresist layer; etching the dielectric layer and the contact in the etching apparatus to form a trench; ashing the photoresist and the contact with an inductively coupled plasma in the DCM machine; and wet cleaning the wafer.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably

accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

4. Close art includes "System Level In-Situ Integrated Dielectric Etch Process Particularly Useful for Copper Dual Damascene" by Luo et al., in which an in-situ etch process, ICP photoresist ashing and wet clean are performed in a multi-chambered substrate processing system, not a separate etching apparatus and DCM; "Plasma Ashing Process" by Waldfried et al., in which a photoresist in the presence of a low k dielectric is plasma ashed; and "Method for Low-k/Copper Dual Damascene" by Tu et al., in which a sacrificial plug of polysilicon to be replaced by copper is etched, the photoresist ashed by ICP, followed by a wet clean to prevent the problems associated with etching a low k dielectric; however, there is no mention of a separate apparatus for the etching, ashing and wet clean steps and it is implied the etching and ashing occur in the same chamber.

Conclusion

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Beth E. Owens, Ph.D. whose telephone number is 571.272.1882 and fax number for unofficial communications is 571.273.1882.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Elms, can be reached on 571.272.1869. The fax phone number

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for the organization where this application or proceeding is assigned is 703.872.9306
for official communications.

Any inquiry of a general nature or relating to the status of this application or
proceeding should be directed to the receptionist whose telephone number is
571.272.2800.

BEO

BEO 09.17.04


VANTHU NGUYEN
PRIMARY EXAMINER